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Madeleine A. Fritz

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Contents

Redescription of Type Specimens of Bryozoan *Stigmatella* from the Upper Ordovician of the Toronto Region, Ontario

Abstract

The type specimens of the bryozoan genus *Stigmatella* from the Upper Ordovician rocks of Toronto and vicinity, originally described by Parks and Dyer (1922), Dyer (1925), and later restudied by Armstrong (1945), are redescribed and refigured according to present day standards. The specimens, representing eight distinct species or varieties, are located in the Department of Invertebrate Palaeontology of the Royal Ontario Museum. This fauna has not been recognized in localities outside the Toronto area. The emended descriptions and improved illustrations may lead to the discovery of the faunal assemblage elsewhere in regions where it might be expected to occur.

Introduction

The Upper Ordovician rocks that underlie Toronto and vicinity belong to the Georgian Bay Formation (Liberty, 1969). Formerly two formations were thought to be present. They were classified, in ascending order, as Dundas and Meaford and correlated respectively with Maysville and Richmond of Ohio. Bryozoa are abundant in these rocks. This fauna was described and studied by Parks and Dyer (1922) and Dyer (1925). Armstrong (1945) restudied the genus *Stigmatella*. The new species or varieties designated by the above authors have not been recognized from outside the Toronto area owing to the brief, outmoded descriptions and poor illustrations. I have undertaken to redescribe and refigure, according to present practice, the type specimens designated by the above authors. These specimens are located in the Department of Invertebrate Palaeontology of the Royal Ontario Museum. The more detailed descriptions and improved illustrations may lead to the recognition of the fauna in rocks of similar age in localities elsewhere.

My paper (1970) dealt with the genus *Hallopora* Bassler (1911). This study deals with the presently known species of the genus *Stigmatella* found in the Toronto area. One variety referred to, *S. catenulata diversa* Parks and Dyer (1922), was redescribed and refigured by Fritz (1971) as *Mesotrypa catenulata diversa* (Parks and Dyer). In my opinion the term variety or subspecies in palaeontology, especially in rocks as old as the Ordovician,

has no genetic significance and should not be used. But in view of the limited material at present available, I have redescribed and refigured the *Stigmatella* types with the nomenclature formerly proposed. It is almost certain that other specific variations occur in the rocks in question. In support of this premise further careful collecting throughout the formation would be necessary.

Materials and Methods

The type specimens of eight taxa of the genus *Stigmatella* are redescribed in the following order:

Stigmatella catenulata var. A Parks and Dyer (1922)
Stigmatella halysa Armstrong, 1945 (= *S.catenulata* var. B Parks and Dyer (1922))
Stigmatella halysa crassa Armstrong, 1945 (= *S.sessilis crassa* Dyer, 1925)
Stigmatella halysa erindalensis Armstrong, 1945
Stigmatella crenulata Ulrich and Bassler (1904)
Stigmatella hybrida Dyer (1925)
Stigmatella personata lobata Dyer (1925)
Stigmatella vulgaris Parks and Dyer (1922)

In addition to the above species, three other forms of *Stigmatella* were described by the early writers:

S.alcicornis Cumings and Galloway (1913, p. 436)
*S.*cf.*clavis* (Ulrich, 1883, p. 161)
S.lambtonensis Parks and Dyer (1922, p. 14)

S.alcicornis was identified by Armstrong (1945, p. 150) from a single, poorly-preserved specimen. My examination of the specimen leads to the conclusion that the species is indeterminable.

LOCALITY—Humber member, Dundas Formation at Humbervale quarry, near Toronto.

TYPE—Plesiotype ROM 1180HR.

*S.*cf. *clavis* (Ulrich, 1883, p. 161). The identification by Parks and Dyer (1922, p. 16) was based mainly upon external features of three specimens, in each the zoarium being chub-shaped. Armstrong (1945, p. 151) suggested a relationship with *S.halysa.* Additional material would be necessary to validate the species.

LOCALITY—16-foot level, Humbervale quarry.

TYPE—Plesiotype ROM 1183HR.

S.lambtonensis Parks and Dyer (1922, p. 14). The authors based their diagnosis upon a single specimen now known to represent a species of the genus *Dekayia* Armstrong (1945, p. 153). Verification of this identification is possible only when further specimens are recovered.

LOCALITY—5-foot level, old shale pit, Lambton, Ontario.

TYPE—Holotype ROM 1090.

External features of specimens were examined either by the naked eye or with the aid of a hand lens. Microstructure was determined by means of thin sections. Mensuration for the number of zooecia in 2 mm in the intermonticular areas and the measurements in mm of maximum zooecial apertures in the monticular and intermonticular areas were carried out with the aid of a binocular microscope and a micrometer scale calibrated to 0.01 mm. The number of entire acanthopores in 1 mm^2 and the number of entire mesopores in 1 mm^2 were obtained by using a compound microscope and a reticle calibrated to 1 mm^2. The mean, standard error, and standard devition were computed on a Monroe 990 desk calculator (Monroe – The Computer Company, Orange, New Jersey). Student's *t*-test was employed to show significance of differences between means (Simpson *et al.*, 1960).

Systematic Palaeontology

Order TREPOSTOMATA Ulrich 1882
Family HETEROTRYPIDAE Ulrich 1890
Genus *Stigmatella* Ulrich and Bassler, 1904

Ulrich and Bassler's description of *Stigmatella* follows:

"Zoarium variable, ranging from incrusting to irregularly massive and ramose. Zooecia angular, rounded, or irregularly petaloid, the shape depending upon the presence (or absence) of mesopores and the number of acanthopores. Typically the zoarial surface exhibits at regular intervals maculae or spots composed of mesopores, although in some species the usual monticules or clusters of large cells occur. Acanthopores always present but variable in number, intermittent, developed chiefly in narrow zones, sometimes inconspicuous but more often so numerous as to give the surface a decidedly hirsute appearance. Mesopores, when present, developed in mature regions only, their number being variable even for the same species.

"The zooecial tubes have thin walls in the axial region and these become but slightly thickened in the peripheral region where a few unusually delicate diaphragms are inserted. In vertical sections the walls exhibit at rather regular intervals in the peripheral region thickenings somewhat similar to those occurring in *Stenopora*. These thickenings occur aproximately at the same height in the walls, and tangential sections through these zones give the full development of acanthopores. Minute structure of walls as shown in tangential sections, of the type that characterizes the *Heterotrypidae*."

Type species – *Stigmatella crenulata* Ulrich and Bassler, 1904
***Stigmatella catenulata* var. A, Parks and Dyer, 1922**

(Fig. 1 B, C)

Stigmatella catenulata Cumings and Galloway, 1913, p. 437.
Stigmatella catenulata var. A Parks and Dyer, 1922, p. 13, pl. 3, figs. 1, 2.
Stigmatella catenulata Armstrong, 1945, p. 150.

Cumings and Galloway's description:

"Zoarium robust, subramose, 1.5 to 2 cm in diameter and 5 or 6 cm long. Surface nearly smooth, with low, round monticules or large maculae, composed of mesopores and large zooecia. Zooecia subcircular, with medium thin walls. Mesopores are usually restricted to the clusters, but sometimes, on immature branches, there may be a small area in which mesopores are numerous.

"Tangential sections show the zooecia to be subpolygonal and thin walled, with a light-coloured intermural line; 9 zooecia in 2 mm. Where there are mesopores the zooecia are smaller, but there is the same number in 2mm, including mesopores. The acanthopores are small but conspicuous, about half the size of number 1, that is, 1/40 mm in diameter, about 10 in 10 zooecia. They are situated at the angles of junction of the zooecia and never inflect the zooecial wall. Mesopores are usually few or absent in sections near the surface, but occasionally a section will show a region of numerous mesopores, especially if the section is deep or taken from an immature branch.

"Diaphragms are absent in the axial region and there are only one or two in the mature region. The zooecial walls are only slightly thickened in the mature region, which is 2 or 3 mm in depth. The chain-like mesopores are the noticeable feaure of longitudinal sections. They begin in the submature region and ordinarily do not reach the surface. Where the diaphragms cross the mesopores there is a constriction, giving to the mesopores the appearance of chains or strings of beads. The zooecial walls are nearly straight or only slightly flexuous.

"This species is evidently most closely related to *Stigmatella interporosa* Ulrich and Bassler, which it resembles, but it may be distinguished from that species by its more rebust [*sic*] habit of growth, thicker mature region and less numerous mesopores and greater development of chain-like mesopores."

Parks and Dyer's description:

"Species of *Stigmatella* showing distinct chain-like mesopores are of frequent occurrence in the rocks at Toronto. The only species in which the character is pronounced are: *S.interporosa* Ulrich and Bassler, *S.sessilis* Cumings and Galloway, and *S.catenulata* Cumings and Galloway. All of our specimens are distinct from *S.interporosa* as the great development of mesopores characteristic of that species is not seen. One of them resembles *S.sessilis*, and three others approach so close to *S.catenulata* that they are included in that species although varietal differences are marked.

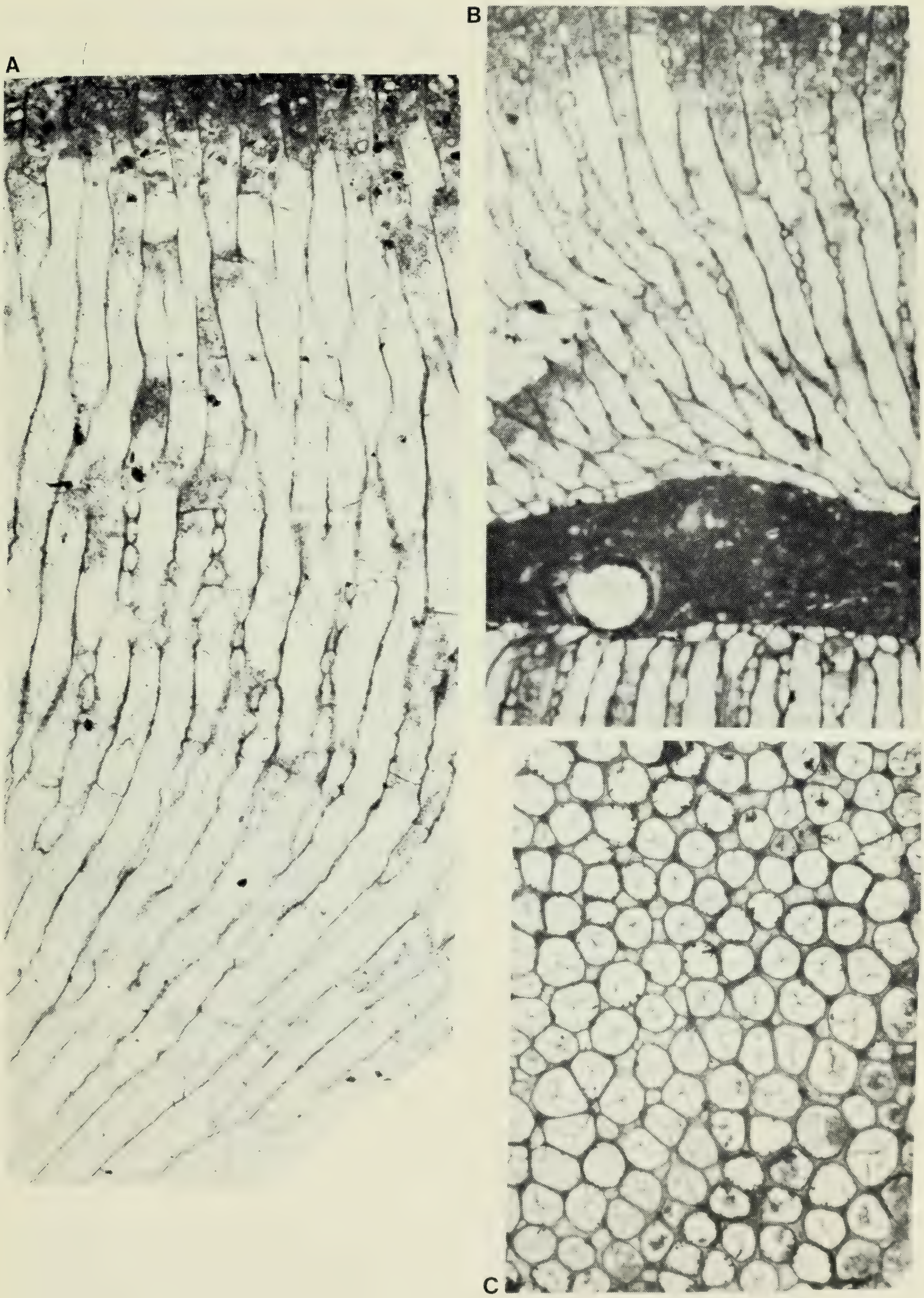

Fig. 1—Stigmatella halysa crassa Dyer, holotype ROM 1292HR. A. Longitudinal section, ×30. *Stigmatella catenulata* var. A Parks and Dyer, holotype ROM 1087HR. B. Longitudinal section, ×30; C. Tangential section, ×30.

"The first type which we may call Variety (A) approaches most closely to typical *S. catenulata*. The zoarium is irregularly ramose, with flattened branches which appear to be hollow. An average branch is about 15 mm by 8 mm. The surface is marked by very small and inconspicuous monticules, 2 to 3 mm apart.

"Tangential sections show groups of larger, thin-walled, polygonal zooecia to the number of nine in a space of two millimetres, and areas with considerably smaller and more rounded zooecia with frequent mesopores. As many as twelve zooecia were counted in the space of two millimetres. Sections very near the surface present almost exactly the appearance of Cumings and Galloway's figures except that the acanthopores are not rigidly confined to the angles of the zooecia. Sections at moderate depth show scattered large acanthopores; many of them not at the angles of junction, and strongly inflecting the zooecial cavity. Sections cut at a still deeper level are almost devoid of acanthopores.

"Vertical sections show that the tube walls increase very little in thickness towards the surface and that the characteristic chain-like mesopores are well developed. Diaphragms in the zooecial tubes are of rare occurrence.

"This variety differs from the type only in the character of the acanthopores and in the more rugose surface."

Emended description

EXTERNAL FEATURES—Zoarium a small, somewhat fan-shaped growth encrusting crinoid stem, height 27 mm, width at base 9 mm, width at summit 21 mm, maximum thickness at mid-height 14 mm. Surface elevations, with basal diameter 3–5 mm, represent aborted branches. Small monticules occur at intervals of 2–3 mm.

TANGENTIAL SECTION—Zooecial apertures angular in deep sections where wall thin; subangular to subcircular, at times nearly circular in sections near zoarial surface where wall thickness and in places slightly inflected by acanthopores, mostly 8–11 zooecia in 2 mm in intermonticular space (Table 1); zooecial walls in deep sections 0.01 (or less) to nearly 0.02 mm thick, toward surface 0.02–0.05 mm thick, to 0.07 mm thick in monticules, wall concentrically laminated, median band commonly light in colour. Mesopores few to relatively numerous (Table 1), mostly triangular to rectangular and often in pairs. Acanthopores moderately abundant (Table 1), locally inflecting, 0.01–0.06 mm in diameter, with central lumen surrounded by dense, concentric laminae, from four to six located at junction of three adjacent zooecia. Monticules with larger zooecia than in intermonticular areas (Table 1).

LONGITUDINAL SECTION—Zooecia generally subprostrate for a short distance from base, then straight to surface, where they open at right angles or nearly so; walls mostly straight, monilae rare; wall thin in axial region, thickening from base of peripheral zone; laminae of wall sharply convex outward, diverging from line of demarcation at moderately low angle and passing into diaphragms. Diaphragms horizontal, rare, but owing to crystallization others may possibly have been destroyed. Chain-like mesopores prominent

throughout. Acanthopores in both axial and peripheral zones, lumen surrounded by laminae, convex outward, diverging at a low angle.

REMARKS—The small, somewhat fan-shaped, encrusting zoarium readily distinguishes this variety from *S.catenulata* Cumings and Galloway (1913), which is a robust, ramose, non-encrusting form from the Richmond, Cuts 10 and 11, Harmon's Station, Indiana. Externally *S.catenulata* var. A more closely resembles *S.incrustans* Cumings and Galloway (*op. cit.*) from the Richmond, Cut 17, Weisburg, Indiana, but is distinguished from that species by smaller zooecia, fewer diaphragms, and more numerous mesopores. Furthermore, both *S.catenulata and S.incrustans* are found at a higher horizon than is the present variety. *S.catenulata* var. A is related to *S.catenulata* var. B Parks and Dyer 1922 (= *S.halysa* Armstrong, 1945) and also to *S.sessilis crassa* Dyer 1925 (= *S.halysa crassa* Armstrong, 1945), which occur in associated rocks. Significant differences are indicated in Table 1.

In that *Stigmatella catenulata* var. A differs from known species or varieties, it should probably be given the rank of species, but I hesitate to create a new taxon on evidence provided solely by the holotype.

LOCALITY—Dundas Formation, Humber Member, Upper Ordovician, Lambton, Ontario.

TYPE—Holotype ROM 1087HR.

Stigmatella halysa Armstrong, 1945

(Fig. 2A-D)

Stigmatella catenulata Cumings and Galloway, 1913, p. 437.
Stigmatella catenulata var. B Parks and Dyer, 1922, p. 13, pl. 3, fig. 3.
Stigmatella halysa Armstrong, 1945, p. 153, 154, text–figs. 5, 12.

Armstrong's description follows:

"Zoarium incrusting; type specimen encircles crinoid column for at least 90 mm; maximum thickness 22 mm; resultant form somewhat cylindrical, tapering slightly to each end; surface nearly smooth, but showing some inconspicuous, low rounded elevations spaced irregularly; zooecial opening in elevations slightly larger than elsewhere.

"Two sizes of zooecia in tangential section; larger 8 in 2 mm, smaller 10 or 11 in 2 mm; openings circular to subcircular, walls moderately thick. Acanthopores numerous, about 10 in 10 zooecia; mostly in angles of junction, but found slightly inflecting walls of zooecia; size no. 1 in Cumings and Galloway's scale, that is, about 1/20 mm in diameter; central lumen clear, about 1/75 mm in diameter. Mesopores rather common, suggestion of aggregation in one spot in type.

"Vertical sections indicate zooecia have thin, straight walls with characteristic periodic thickenings; featured by chain-like mesopores beginning at mid-radius, continuing to periphery of zoarium; number of 'links' 4 to 15. Acanthopores numerous, traceable almost into axial region; diaphragms sparsely developed, tending to appear simultaneously in all zooecia; no noteworthy peripheral thickening of walls.

"Parks and Dyer (1922) recognized this form as *S.catenulata* Var. B. The specific name has been given in recognition of the characteristic chain-

like mesopores. This species resembles *S.catenulata* from which it may be distinguished chiefly by its habit of growth, and by the size and distribution of acanthopores, which in *S.catenulata* are small, inconspicuous and restricted to the angles of junction of the zooecia."

Emended description

EXTERNAL FEATURES—Zoarium cylindrical or pipe-shaped, 90 mm long, overgrowing a centrally located crinoid stem; maximum thickness of encrustation 9 mm. Surface eroded but small monticules still visible, 2–2.5 mm apart when measured from centre to centre, and consisting of larger zooecia than in intermonticular space.

TANGENTIAL SECTION—Zooecia angular in deep sections where wall thin, subangular to subcircular near surface where wall thicker, usually 8–10 zooecia in 2 mm in intermonticular space (Table 1); zooecial walls in deep sections 0.01 mm (or less) thick, 0.02–0.05 mm near surface and slightly thicker in monticules, the wall concentrically laminated with light-coloured central ring. Mesopores few to moderately numerous (Table 1), in monticules often in clusters. Acanthopores relatively abundant, 0.01–0.04 mm in diameter, five may occur where four zooecia in conjunction, some slightly inflect the zooecial wall. Zooecia in monticules larger than those in intermonticular space (Table 1).

LONGITUDINAL SECTION—Initially zooecia prostrate, then curve broadly and later straighten to intersect zoarial surface nearly at right angles; zooecial walls straight, thin in axial zone where monilae appear at regular horizons across section; walls thicken slightly from base of peripheral zone to surface; wall laminae sharply convex outward, diverging from median light-coloured band at moderately low angle and passing into diaphragms. Diaphragms few, generally horizontal, widely spaced, in general two in each growth period. Chain-like mesopores conspicuous. Structure of acanthopores similar to that of zooecial wall.

REMARKS—*Stigmatella halysa* Armstrong (1945) (= *S.catenulata* var. B. Parks and Dyer, 1922) and *S.catenulata* var. A Parks and Dyer are similar species. Zooaria in each encrust a crinoid stem. In *S.halysa* the zoarial shape is cylindrical or pipe-shaped, and small, low monticules often with central clusters of mesopores, are present. In *S.catenulata* var. A, the zoarium is fan-shaped, giving rise to aborted branches, and monticules are well-defined, without central concentration of mesopores. Armstrong (1945) considered *S.sessilis crassa* (Dyer, 1925) to be a variety of *S.halysa*, basing his conclusion solely on the manner of growth of that species, but as shown in Table 1, when the two are compared they differ in number of zooecia in 2 mm, measurement of maximum zooecial apertures in monticules or maculae, measurement of maximum zooecial apertures in the intermonticular/intermacular areas. As indicated in the description of *S.halysa crassa*, the three species here mentioned are compared in pairs in Table 1.

LOCALITY—Dundas Formation, Humber Member, Upper Ordovician, Lambton, Ontario.

TYPE—Holotype ROM 1088HR.

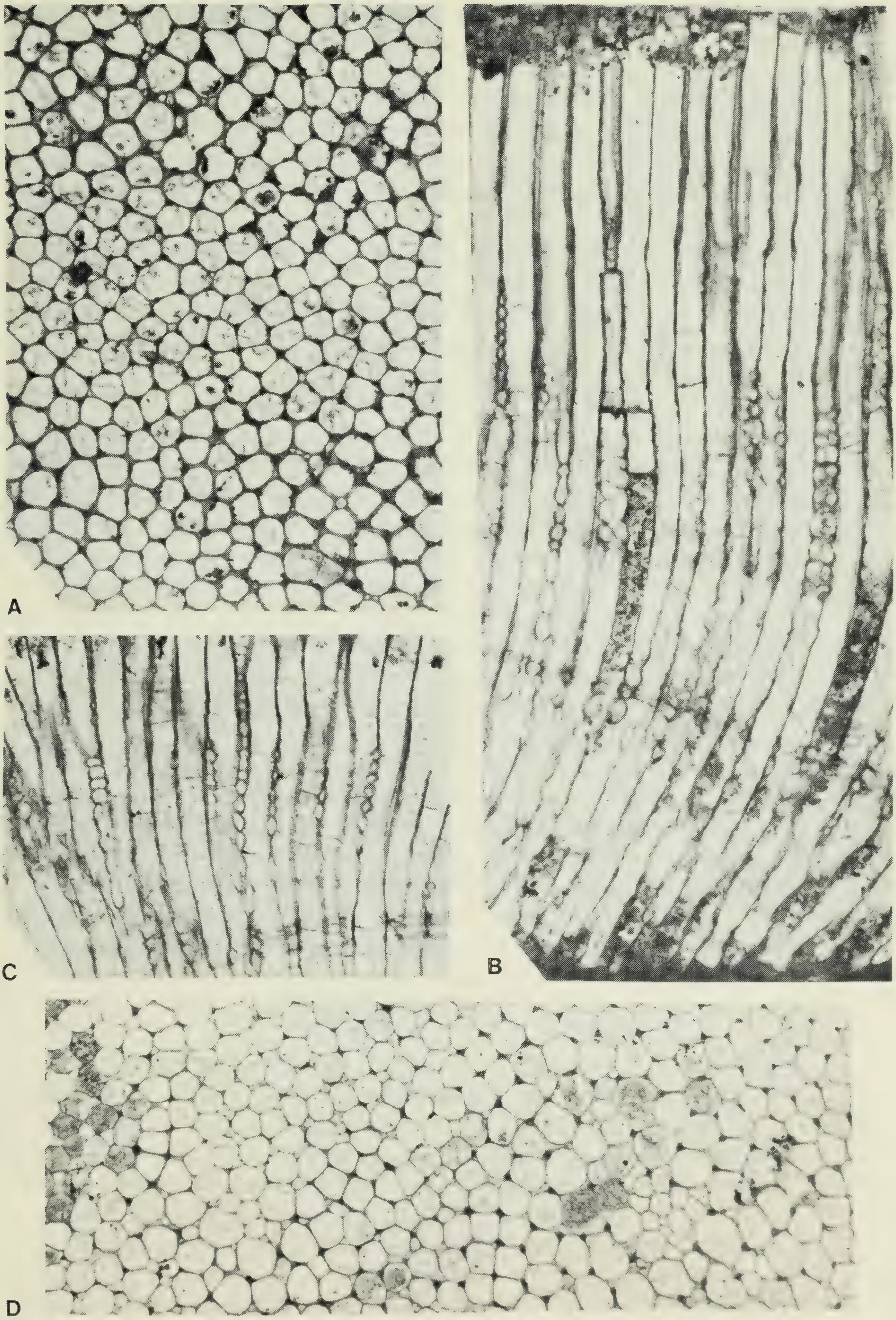

Fig. 2—Stigmatella halysa Armstrong, holotype ROM 1088HR. A. Tangential section, ×30; B. Longitudinal section, ×30; C. Longitudinal section, ×30; D. Tangential section, ×30.

Stigmatella halysa crassa Armstrong, 1945
(Figs. 1A, 3D)

Stigmatella sessilis crassa Dyer, 1925, p. 72, pl. 6, fig. 10.
Stigmatella halysa crassa Armstrong, 1945, p. 154, text–figs. 6, 7.

Dyer (1925) stated:

"The variety *Stigmatella sessilis crassa* is abundant in the Credit Member. It is very similar to *S.sessilis* Cumings and Galloway in internal characters, but differs decidedly in manner of growth. The variety forms coarse irregular zoaria, tightly adhering to the fragments of other fossils, chiefly the trilobite *Isotelus*. In some parts, the zoarium is as thin as two millimetres, but in other parts it is very coarse, approaching 20 mm in thickness."

Armstrong's (1945) description was:

"Zoarium tightly encrusts fragment of *Isotelus* to thickness of 20 mm. Thin sections show very close affinities with *S.halysa* [*S.catenulata* var. B]. In tangential section zooecia are thin-walled, subpolygonal to subcircular; 10 or 12 in 2 mm; acanthopores both in angles of junction and inflecting walls of zooecia; mesopores few in number. Vertical sections are identical to *S.halysa* except for less numerous acanthopores."

Emended description

EXTERNAL FEATURES—Zoarium encrusts pygidium of trilobite *Isotelus*, thickness 2–15 mm, from which branches arise. Surface not observed, but groups of zooecia present in thin sections.

TANGENTIAL SECTION—Zooecial apertures angular at depth and thin-walled, subangular to subcircular near zoarial surface where wall thickens, mostly 8–11 zooecia in 2 mm (Table 1); in deep section zooecial walls 0.01 (or less) to 0.02 mm thick, increasing to 0.06 mm near surface; wall concentrically laminated. Mesopores few to relatively numerous (Table 1), triangular to quadrangular, often in pairs, Acanthopores moderately abundant (Table 1, 17–34 in 1 mm^2), occasionally slightly inflecting, 0.02–0.06 mm in diameter, with central lumen encompassed by dense concentric laminae. Zooecia in groups (monticules/maculae), larger than in intervening areas (Table 1).

LONGITUDINAL SECTION—Zooecia subprostrate for short distance, then sweeping in a broad curve to open slightly obliquely at surface; walls mostly straight, locally undulating or crenulate, monilae at intervals, developing at same level throughout section, tenuous in axial zone, thickening two-fold or more in mature zone; wall laminae convex outward, diverging from clear median band at moderately low angle and passing into diaphragms. Diaphragms horizontal, widely spaced, commonly two or three in a single growth period. Chainlike mesopores, mostly in single or double files. Acanthopores present throughout the section, from central lumen laminae diverging outward at moderately low angle and passing into diaphragms.

REMARKS—*S.halysa crassa* (= *S.sessilis crassa* Dyer) differs from *S.sessilis*, a discoidal form from the Maysville, Cut 7 on the Big Four Railroad, near Manchester Station, Indiana, in the shape of zoarium, fewer diaphragms,

more numerous mesopores, and locally inflecting acanthopores. In addition to the holotype three fragmentary, poorly preserved topotypes occur in the collection. This variety probably represents a new species but until more material is found the present designation is retained. *S.catenulata* var. A and *S.halysa* are also related. The three forms were compared quantitatively in pairs, and significant differences are expressed in Table 1.
LOCALITY—Dundas Formation, Credit Member, Upper Ordovician, Erindale, Ontario.
TYPES—Holotype ROM 1292HR; topotypes ROM 1321HR, 1322HR, 1323HR.

***Stigmatella halysa erindalensis* Armstrong, 1945**

(Fig. 3 A-C)

Stigmatella halysa erindalensis Armstrong, 1945, p. 154, text-figs. 8, 9.

Armstrong's description follows:

"Zoarium encrusts fragment of pelecypod shell to thickness of 5 mm and gives off two branches; surface smooth; no evidence of maculae or monticules. In tangential section zooecia moderately thick-walled, rounded to subcircular; somewhat smaller than in *S.halysa*, 11 or 12 in mm; acanthopores and mesopores few and scattered. In vertical section zooecia show thin, straight walls; diaphragms numerous due to close succession of growth stages indicated by slight increase in thickness of walls and presence of acanthopores."

Emended description

EXTERNAL FEATURES—Zoarium a small, sheet-like growth upon fragment of a mamelose stromatoporoid, a maximum thickness 3 mm; from the encrustation arise branches 4–6 mm in diameter, only bases preserved. Surface with small, low monticules, 2–2.5 mm apart when measured from centre to centre.
TANGENTIAL SECTION—Zooecia angular in deep sections where wall thin, subangular to subcircular toward periphery where wall thickens appreciably, commonly 11 zooecia, rarely 12 in 2 mm in intermonticular space (Table 2); zooecial walls in deep sections mostly 0.01 mm thick, 0.02–0.04 mm thick near surface, to 0.05 mm thick in monticules, wall concentrically laminated with central, light-coloured band or black line of demarcation. Mesopores few to moderately numerous in intermonticular space (Table 2). Acanthopores numerous (Table 2), 0.02–0.05 mm in diameter, seven to nine common where four zooecia in conjunction, five to six at junction of three adjacent zooecia, lumen small, surrounded by dense concentric laminae. Zooecia in monticules few and larger than those in intermonticular space (Table 2).
LONGITUDINAL SECTION—Initial zooecia either prostrate or curved, then upright, cutting zoarial surface slightly obliquely; zooecial walls thin, mostly straight in axial zone, thickening abruptly from base of mature zone through which they become monoliform or, in places, crenulate, wall laminae convex outward, diverging from median band at moderately low angle and passing

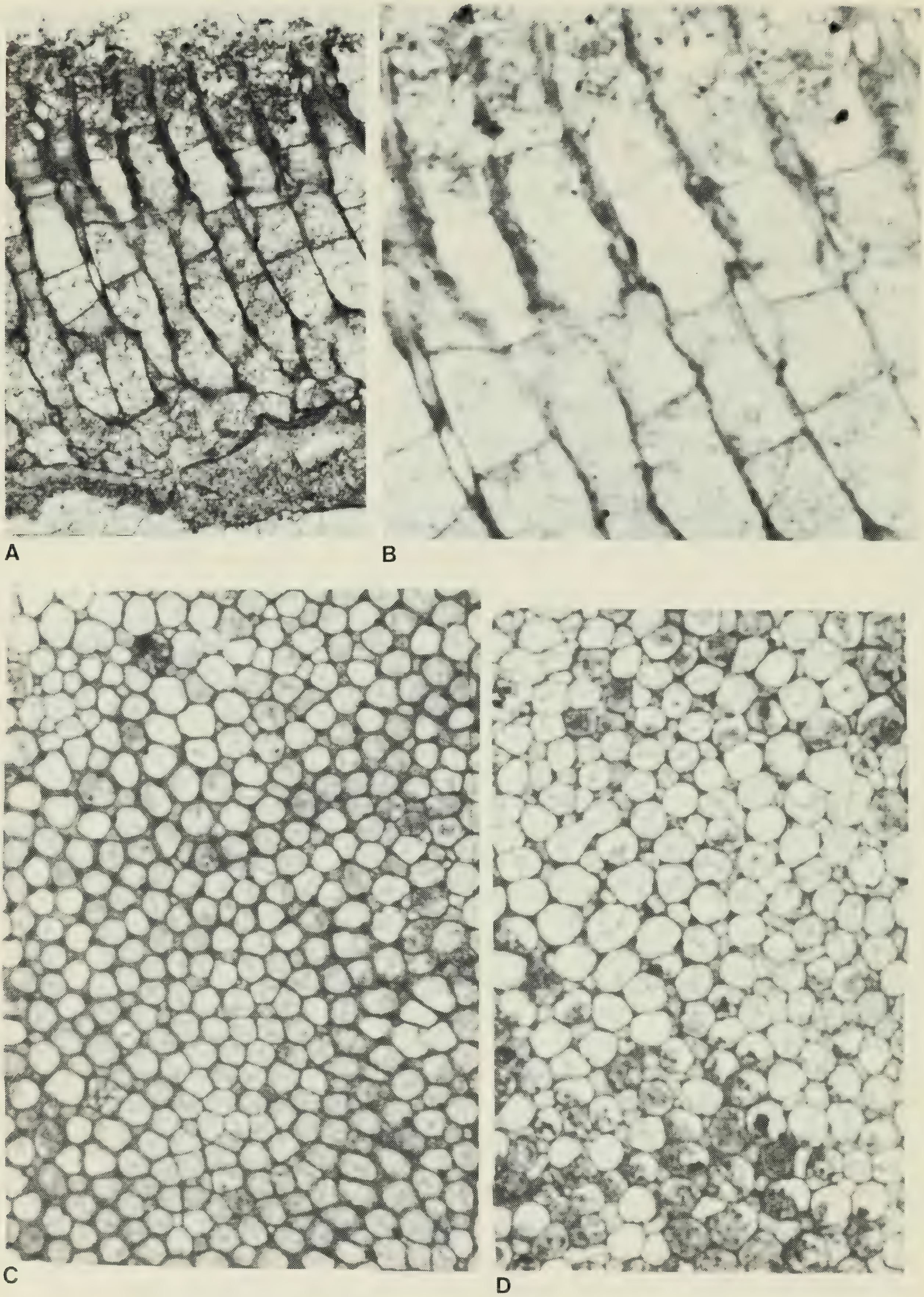

Fig. 3—Stigmatella halysa erindalensis Armstrong, holotype ROM 12244. A. Longitudinal section, ×30; B. Longitudinal section, ×60; C. Tangential section, ×30. *Stigmatella halysa crassa* Dyer, holotype ROM 1292HR. D. Tangential section, ×30.

into diaphragms; diaphragms mostly horizontal, spaced apart one, two, to three tube diameters. Mesopores few, chain-like. Acanthopores prominent particularly in peripheral region, composed of laminae convex outward and diverging from relatively narrow central band at moderately low angle. In both tangential and longitudinal sections structures reaching 1 mm in diameter represent sections through mamelons on surface of host.

REMARKS—Armstrong based his description of the variety *S.halysa erindalensis* on a single example that was found among specimens identified as *S.lambtonensis* Parks and Dyer (1922), now *Dekayia lambtonensis* (Parks and Dyer). *S.halysa erindalensis*, from the Meaford Formation, and *S.halysa*, from the Dundas Formation, are similar in habit of growth, but *S.halysa erindalensis* is smaller and more delicate. In the latter zooecia are smaller, acanthopores fewer, and the zooecial apertures in the monticules and intermonticular areas are fewer. The two are compared in Table 2. Significant differences are shown in the number of zooecia in 2 mm in the intermonticular-intermacular areas and in the maximum apertural diameter of the zooecia in both the monticules or maculae and in the intervening areas. In my opinion *S.halysa erindalensis* warrants specific rank, but, until additional specimens are found, the present designation is retained.

LOCALITY—Meaford Formation, Erindale Member, Streetsville, Ontario.

TYPE—Holotype ROM 12244.

Stigmatella crenulata Ulrich and Bassler, 1904

(Fig. 4A, C)

Stigmatella crenulata Ulrich and Bassler, 1904, p. 34, pl. 9, figs, 1–4; pl. 14, figs. 1, 2.

Stigmatella crenulata Dyer, 1925, p. 54, pl. 4, fig. 6; pl. 7, fig. 8.

Stigmatella crenulata Armstrong, 1945, p. 151, figs. 1 and 2.

This species was originally described from the lower Richmond Formations, Butler County, Ohio, and the types are in the United States National Museum (USNM 43197–43199).

Ulrich and Bassler's description of *S.crenulata* follows:

"Zoarium composed of cylindrical, subcylindrical or compressed, frequently dividing stems 10 mm in diameter, arising from a broad base and forming a clump probably seldom more than 50 mm high. Surface even, but in well preserved mature specimens spinulose because of the many acanthopores. Maculae well marked, generally composed of mesopores which make up the characteristic 'spots' but sometimes formed exclusively of zooecia larger than the ordinary. Zooecial apertures small, about 9 in 2 mm with their walls thin and often beautifully inflected by the numerous small acanthopores. Mesopores present, variable in number but usually few and mostly aggregated in the maculae. In the axial region the zooecial tubes have thin, finely crenulated walls, and occasionally a diaphragm or two. In the mature region the walls increase slightly in thickness, mesopores and acanthopores develop, and thin diaphragms cross the zooecial tubes and mesopores at varying though always comparatively remote intervals."

Parks and Dyer (1922, p. 12) stated that the older Dundas strata on the Humber River yielded many examples of this species. Armstrong (1945, p. 151, 152) noted that the Humber species so designated was actually *Stigmatella vulgaris* Parks and Dyer, the most common Dundas *Stigmatella*, a statement that I believe to be correct. But *S.crenulata* occurs in the Erindale member of the Meaford Formation, as pointed out by Dyer (1925, p. 54) and Armstrong (1945, p. 151). Dyer's type is here described in detail for the first time.

Description

EXTERNAL FEATURES—Zoarium fragmentary, a clump-like growth suspected, with branches to 10 mm in diameter; surface with maculae composed of larger zooecia than those in intermacular areas.

TANGENTIAL SECTION—Zooecial apertures angular in deep sections where wall thin, commonly subangular to subcircular near surface where wall somewhat thicker, apertures faintly petaloid owing to inflecting acanthopores; zooecia 9–10 in 2 mm in intermacular area (Table 3), walls 0.01 mm thick in deep section, 0.02 mm near surface, in maculae 0.03–0.06 mm thick; wall concentrically laminated with central, light-coloured band where wall is thick, dark line of demarcation where wall is thin. Small, angular mesopores (Table 3) varying in size, more numerous in maculae where they are commonly centrally located. Acanthopores abundant (Table 3), moderately inflecting, 0.01–0.06 mm in diameter, having small lumen surrounded by dense, concentric laminae, four to six occurring at junction of three adjacent zooecia, situated in angle of zooecia as well as in zooecial walls. Zooecia in maculae larger than those in intermacular area (Table 3).

LONGITUDINAL SECTION—Zooecia curve broadly from axial zone and open slightly obliquely to surface; walls at first thin and undulating, then finely crenulated, with periodic moniliform thickenings, wall laminae sharply convex outward, diverging from line of demarcation at moderately low angle and passing into diaphragms. Diaphragms rare, mostly horizontal, two usually occur in each periodic growth. Mesopores few. Acanthopores common in peripheral zone, rarer in axial zone, wall similar to that of zooecia.

REMARKS—While studying this specimen I also examined three thin sections of syntypes (USNM 43197, two sections; USNM 43198, one section) of *S.crenulata*. So similar in all morphological details are these sections that I have no hesitation in referring the ROM specimen to that species.

LOCALITY—Meaford Formation, Upper Ordovician, Streetsville, Ontario.

TYPE—Hypotype ROM 12297.

Stigmatella hybrida Dyer, 1925

(Fig. 4B, D)

Stigmatella hybrida Dyer, 1925, p. 71, pl. IV, figs. 7, 8; pl. VII, fig. 1.

Original description by Dyer, 1925:

"A bryozoan, which differs from any previously described species, was found in the *Strophomena varsensis* zone of the Streetsville member at

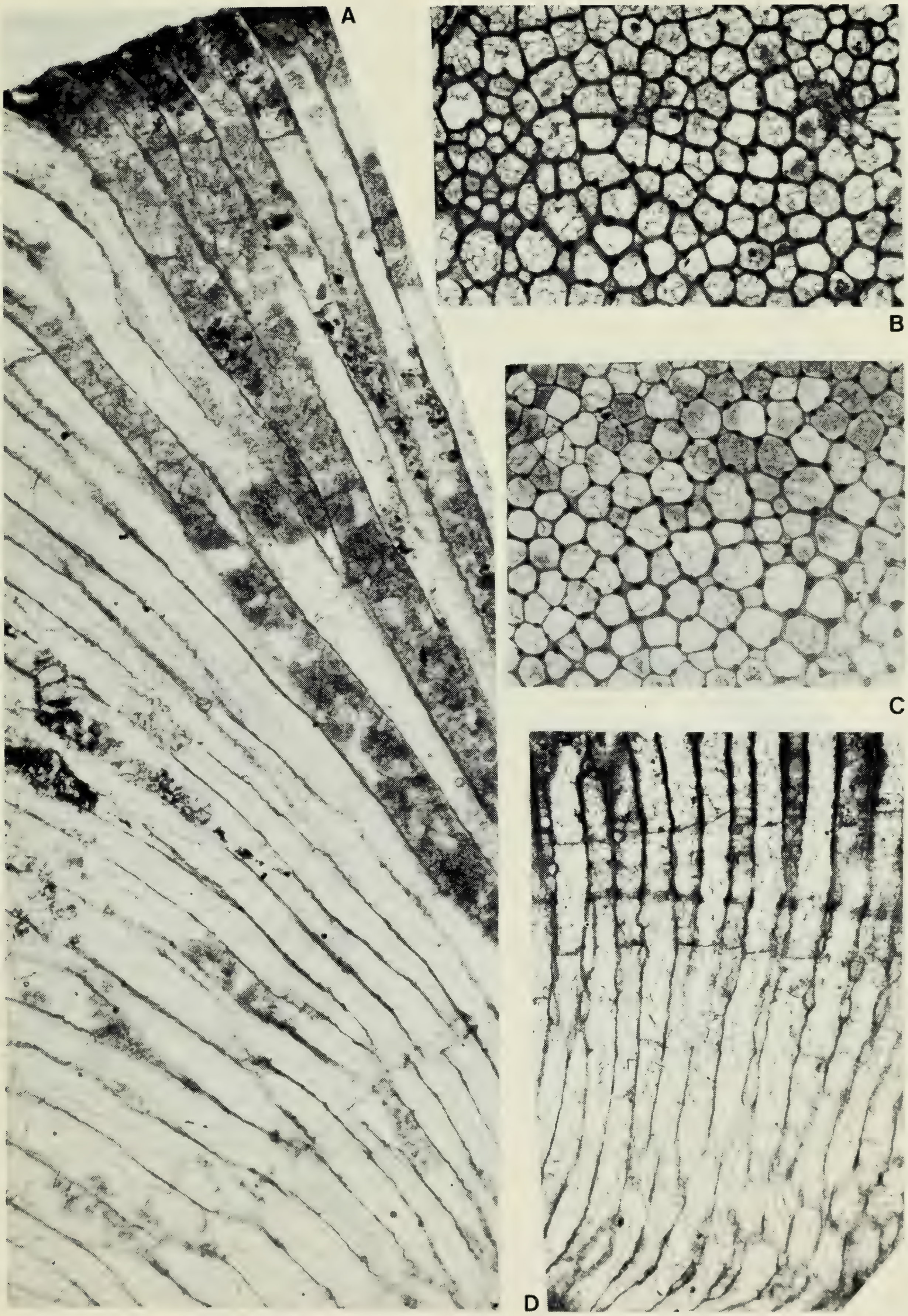

Fig. 4—Stigmatella crenulata Ulrich and Bassler, hypotype ROM 12297. A. Tangential section, ×30; C. Longitudinal section, ×30. *Stigmatella hybrida* Dyer, holotype ROM 12170. B. Tangential section, ×30; D. Longitudinal section, ×30.

Cooksville Creek. The zoarium consists of a large, more or less cone-shaped mass, measuring 40–45 mm in diameter, with smooth surface, there being no evidence of either maculae or monticules.

"In tangential sections, the typical appearance of *S. crenulata*, Ulrich and Bassler, is presented. Zooecial tubes are of medium size. The acanthopores, which are numerous, are found between the junction angles of the walls of the zooecia and strongly inflect the walls. The mesopores are gathered into maculae.

"The features of the aspects as shown by vertical sections, differ decidedly from those of *S. crenulata* and suggest *S. catenulata*, Cumings and Galloway. The zooecial walls are not crenulated as in the former species but are straight as in the latter. There is also a marked development of chain-like mesopores as in *S. catenulata*.

"*S. hybrida* is one of the best defined species of the genus *Stigmatella*. It differs quite strongly in growth and in the combination of characters as seen in sections from any other form in the Cincinnatian series."

Emended description

EXTERNAL FEATURES—Zoarium encrusts a hemispherical, mamelose stromatoporoid upon which two Bryozoa, other than *Stigmatella*, also grew. *S. hybrida* represented by three recurrent growths, interrupted periodically by the associated species. Diameter of entire assemblage, originally considered to represent *S. hybrida* only, approximately 65 mm, height 35 mm. Final growth of *S. hybrida* 10 mm thick. Surface with tiny, pointed monticules, 1–2 mm apart, composed of zooecia larger than those in intermonticular areas and displaying clusters of mesopores. An irregular tuberosity, with basal diameter of 20 mm, extends 15 mm from surface and terminates in a rounded extremity with shallow, central concavity; bases of similar, smaller outgrowths, also present.

TANGENTIAL SECTION—Zooecia angular with thin walls in deep sections, angular to subangular nearer periphery, 10–12 zooecia in 2 mm (Table 4), walls 0.01–0.02 mm thick at depth, 0.03–0.05 mm in peripheral region, slightly thicker in monticules, composed of concentric laminae, median light-coloured area where wall is thick, dark line of demarcation where wall is thin. Acanthopores numerous (Table 4), inflecting, commonly rendering zooecial apertures subpetaloid, seven to 10 normally at junction of three adjacent zooecia, situated in zooecial angles, also in zooecial walls, diameter 0.01–0.04 mm, central lumen surrounded by dense concentric laminae. Mesopores angular to round (Table 4), mostly clustered in monticules. Zooecia in monticules larger than those in intermonticular areas (Table 4).

LONGITUDINAL SECTION—Zooecia arise from base in either subprostrate or semi-upright manner, then become straight to zoarial surface, intersecting it nearly at right angles; zooecial walls mostly straight in axial zone, with monilae and some crenulation in subperipheral zone, traceable at same horizon throughout sections; wall thickening gradually through initial part of peripheral region, uniform thickness maintained thereafter; wall with laminae convex outward, diverging at low angle from demarcation line and

passing into diaphragms. Diaphragms usually horizontal, rare in axial region, in peripheral zone two to three present. Mesopores chainlike but rare. Acanthopores best observed in peripheral area, their central lumen flanked by diverging laminae as those in zooecial walls. Circular structures, diameter 1–2 mm, represent mamelons of the stromatoporoid host.

REMARKS—This species is one of the most easily recognized in the collection. *S. halysa erindalensis* is similar to *S. hybrida* in zoarial growth and host preference, but when compared quantitatively the two species differ significantly —number of zooecia in 1 mm^2 fewer, acanthopores in 1 mm^2 in intermonticular areas more numerous, diameter zooecial apertures in both monticules and the intermonticular areas greater (Table 4).

LOCALITY—Meaford Formation, Upper Ordovician, Cooksville Creek, Ontario.

TYPE—Holotype ROM 12170.

Stigmatella personata lobata Dyer, 1925

(Fig. 5A–C)

Stigmatella personata Ulrich and Bassler, 1904, p. 35, pl. 12, figs. 1–3.
Stigmatella personata lobata Dyer, 1925, p. 72, pl. 6, fig. 1.

Original description of *S. personata* by Ulrich and Bassler follows:

"This is one of the non-mesopored species of the genus and forms smooth, branching zoaria very much like *S. crenulata* and *S. spinosa*. From the former it is distinguished by having fewer acanthopores, no mesopores and in lacking the crenulation of the walls in the immature region. From *S. spinosa* it is separated by its larger zooecia, 7 to 8 being found in 2 mm while 10 are required in that species to cover an equal distance. The acanthopores in *S. personata* also afford a difference, being but seldom more numerous than the junction angles, which they usually occupy. In *S. spinosa*, it will be remembered, they are so abundant that they almost completely surround the zooecium."

Dyer's description of 1925 was:

"A new variety of this species was found among the older collections of fossils at the University. The exact horizon of which is not known.

"*S. personata lobata* differs from the type species (Ulrich and Bassler 1904) in the manner of growth and in the character of the surface; it forms an irregular, lobate mass 30 mm in diameter, with the surface covered by low but conspicuous monticules composed of tubes which are slightly greater in size than the average."

Emended description

EXTERNAL FEATURES—The single zoarial fragment, 30 × 25 × 20 mm, overgrows a crinoid stem. Projecting about 5 mm from surface are several small rounded protuberances suggesting dwarfed branches, terminal diameters of which range from 6–15 mm. Surface with slightly elevated, rounded monticules spaced 2 to 3.5–4 mm apart when measured from centre to

centre, composed of larger zooecia and more numerous mesopores than those in intermonticular areas.

TANGENTIAL SECTION—Zooecial apertures angular in deep sections where wall is thin, subangular or subcircular in sections near the zoarial surface where wall moderately thick, slightly inflected by acanthopores in places, normally 9–12 zooecia in 2 mm in intermonticular areas (Table 5), larger in monticules; zooecial walls 0.01 (or less) to 0.02 mm thick in deep sections, 0.03–0.04 mm in sections near surface, to 0.05–0.06 mm in monticules, wall concentrically laminated. Mesopores few, small, angular to circular, occurring in monticules, normally scarce in the intermonticular areas (Table 5). Acanthopores moderately abundant (Table 5), commonly located at junction of adjacent zooecia, in places inflecting, range in diameter 0.01–0.06 mm, generally 0.02–0.05 mm, small round central lumen surrounded by dense concentric laminae. Zooecia in monticules larger than those in intermonticular space (Table 5).

LONGITUDINAL SECTION—Attitude of earliest part of zooecia not observed, but later zooecia curve out broadly, then turn laterally to reach zoarial surface slightly obliquely, Zooecial walls predominately straight, thin throughout axial region, thickening gradually to base of peripheral zone where wall generally uneven and crenulated, monilae present, often traceable horizontally over a considerable portion of sections; wall laminae convex outward, diverging from median line at relatively low angle, then passing into diaphragms. Diaphragms horizontal, oblique, or curved in mature zone, where two to four occur spaced apart from one to three zooecial diameters, their apparent absence in axial region possibly because of extreme tenuity. Typical mesopores not observed. Acanthopores conspicuous in peripheral sections but not restricted to that zone.

REMARKS—Dyer (1925) based his description on the single zoarial fragment that is assumed to have been recovered from some unknown horizon within the Meaford Formation. Utgaard and Perry (1964), without examining the type of *Stigmatella personata lobata*, stated that the lobate zoarium and more prominent monticules are mere variations in growth form; hence they regarded the variety as a synonym of *S. personata* Ulrich and Bassler, Richmond, Hanover, Ohio (USNM 43201). The lobate zoarium, with prominent monticules, distinguishes this variety externally from *S. personata*. Although these features may be merely an expression of the environment, a significant difference occurs in the number of entire acanthopores in 1 mm^2 (Table 5). I do not consider this form to be synonymous with *S. personata* but hesitate to create a new species on the evidence afforded by one specimen.

LOCALITY—?Meaford Formation, Upper Ordovician, Streetsville, Ontario.

TYPE—Holotype ROM 12171.

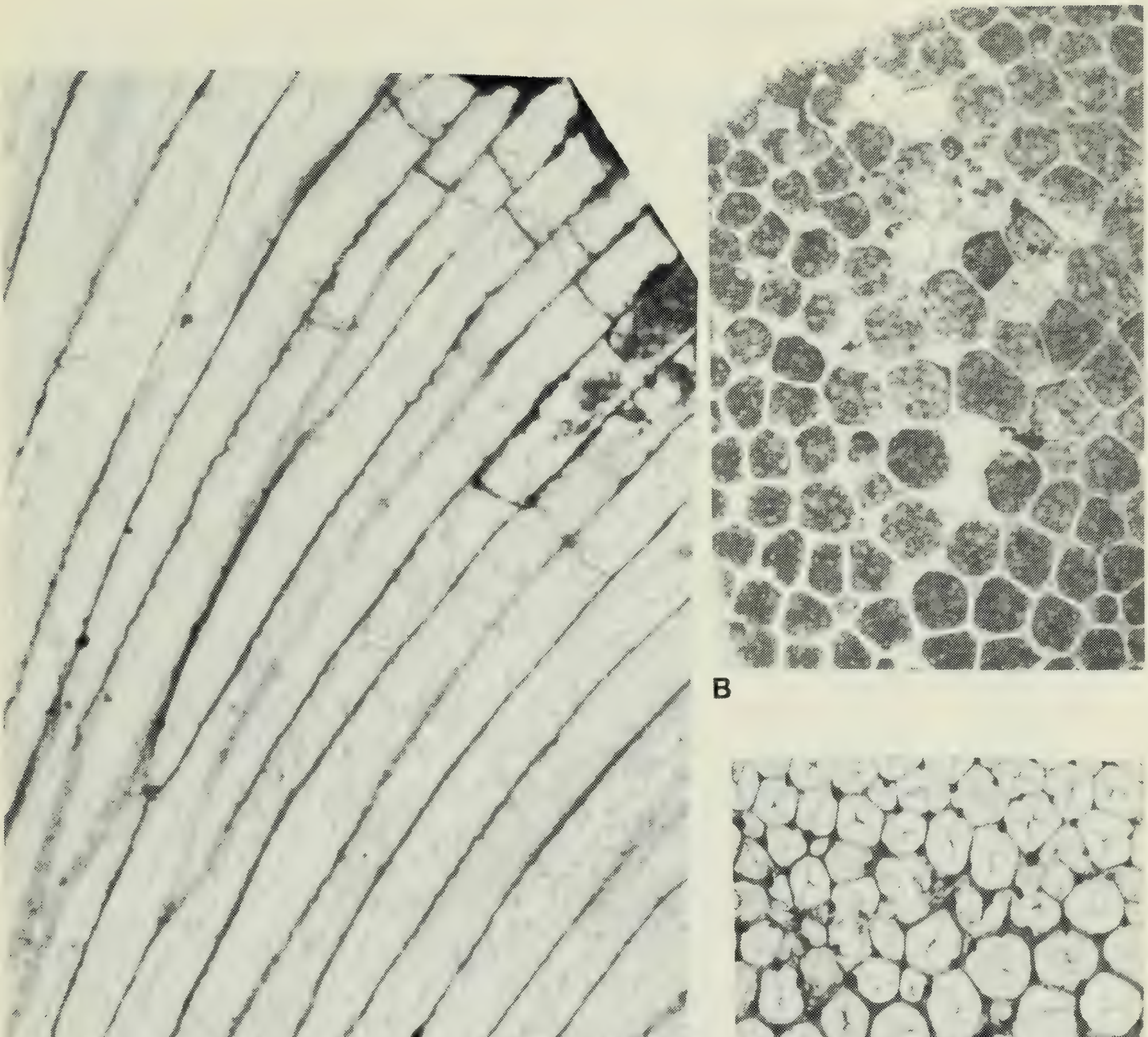

Fig. 5—Stigmatella personata lobata Dyer, holotype ROM 12171. A. Longitudinal section, ×30; B. Tangential section, ×30; C. Tangential section, ×30.

Stigmatella vulgaris Parks and Dyer, 1922
(Fig. 6A–C)

Stigmatella vulgaris Parks and Dyer, 1922, p. 15, pl. 1, figs. 13, 14; pl. 6, fig. 12.
Stigmatella vulgaris monticulata Armstrong, 1945, pl. 155, 156, text-fig. 11.

Original description of Parks and Dyer:

"In the Don Valley brickyard one of the common fossils is the 'puff-ball'. This seems to be a variable species of *Stigmatella* of which the zoarium is of considerable size, massive, nodose, subhemispherical, or even thick discoidal in shape. The appearance of the specimen which is selected as a type is indicated in Plate VI, Figure 12. This specimen measures 80 mm × 55 mm × 30 mm. Other examples, of a roughly hemispherical shape, frequently measure 50 mm in width and 20 or 25 mm in height. While it is quite possible that more than one variety or even species is represented by the various specimens, we have not been able to recognize constant features by means of which they can be differentiated.

"The surface of the type is smooth, and maculae are indicated only by clusters of larger cells very indistinctly developed at intervals. Tangential sections very near the surface (Plate I, Fig. 13) show zooecia of very irregular shape and size with thick walls and numerous large acanthopores. We are inclined to regard the smaller cells as young zooecia rather than as mesopores. In places, the cells are somewhat larger but no other difference is observed. Deep tangential sections are strikingly different: the same irregular character of the tubes is seen, but the walls are extremely thin and the acanthopores less numerous and very small (Plate I, Fig. 14).

"Vertical sections show very thin-walled zooecia crossed by a few distinct diaphragms chiefly in the peripheral zone. No structures which can be interpreted as distinct mesopores are seen. In places the walls are crenulated and in others quite straight. The structure is intermediate between that of *Stigmatella crenulata* and *S. personata*.

"The hemispherical examples of this species show no difference in vertical sections, but tangential sections are almost devoid of acanthopores and groups of larger cells are more distinctly developed; in some cases very large zooecia appear among the smaller ones. In one case the surface is distinctly monticulose but the sections do not differ in any distinct manner."

A variety described by Armstrong (1945), *S. vulgaris monticulata*, is now considered to be synonymous with *S. vulgaris* (Table 6).

Armstrong's description of *S. vulgaris monticulata* follows:

"Surface of zoarium covered with slightly raised monticules; in some monticules 2 mm in diameter occur at intervals of 3 mm; in others, they are larger, 3 mm in diameter, but spaced at 2 mm intervals. Internal structure identical with that of *S. vulgaris*; in tangential section with 6 or 7 larger zooecia in 2 mm, and 10 smaller tubes in 2 mm."

Emended description

EXTERNAL FEATURES—Zoarium of holotype massive, irregular in shape,

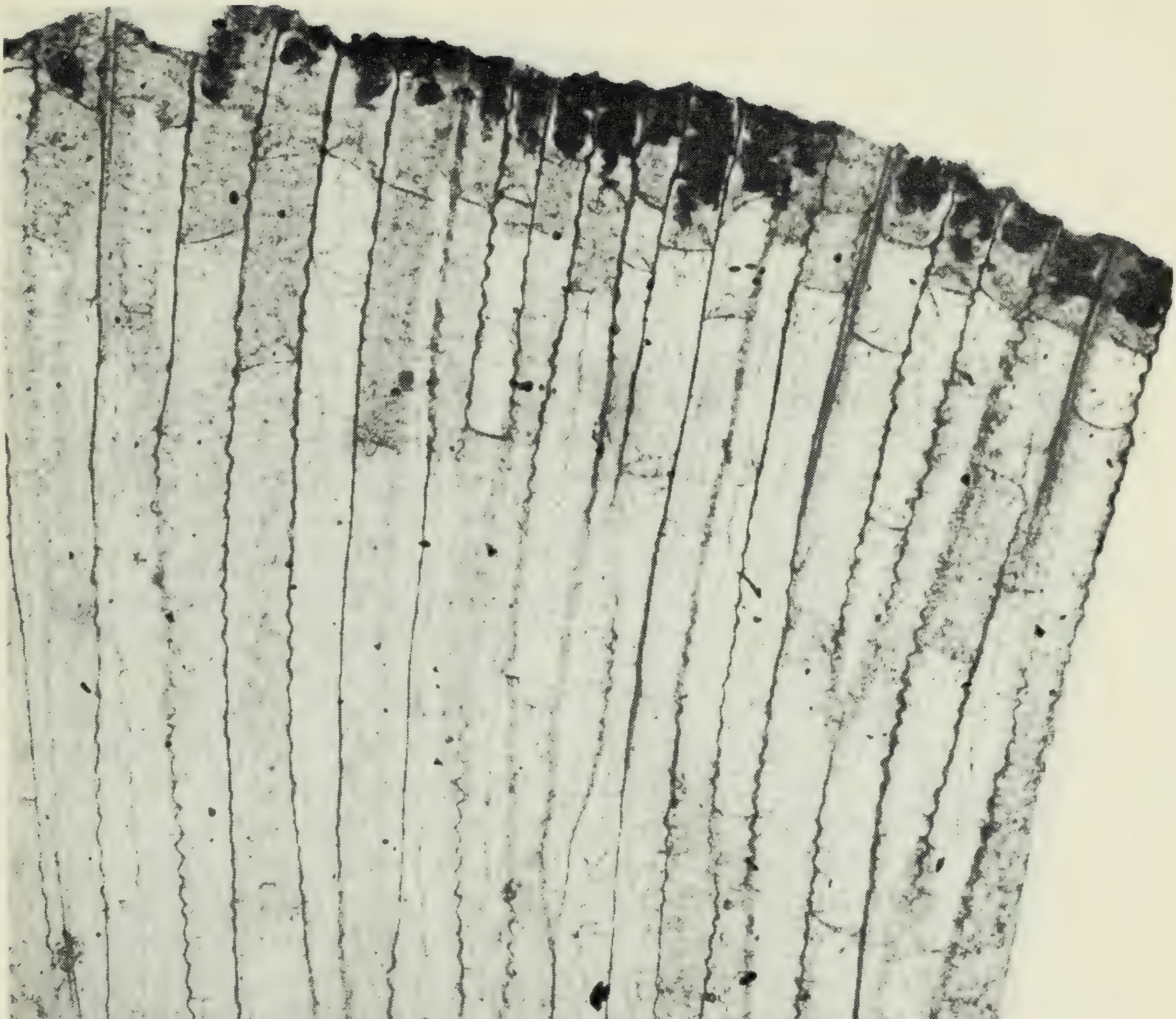

Fig. 6—Stigmatella vulgaris Parks and Dyer, holotype ROM 1091HR, hypotype ROM 1516HR. A. Longitudinal section (ROM 1516HR) ×30; B. Tangential section (ROM 1516HR) ×30; C. Tangential section (ROM 1091HR) ×30.

dimensions 80 × 55 × 30 mm, with lobate extensions, growth beginning on crinoid stem. Surface with low rounded monticules, 2.5–3.5 mm apart when measured from centre to centre, eroded portions of surface appear maculate. Hypotype (*S. vulgaris monticulata* Armstrong) a lobate mass, 80 × 60 × 40 mm, with embedded crinoid stem. Monticules better preserved than in holotype, although obliterated by weathering in certain areas. Zooecia in monticules larger than in intermonticular space.

TANGENTIAL SECTION—Zooecia angular with thin walls in deep sections, subangular in sections near surface where wall thickens appreciably, 7–9 zooecia in 2 mm (Table 6), larger in monticules; zooecial walls 0.01 (or less) to 0.02 mm thick in deep sections, 0.03–0.04 mm near surface to 0.05 mm in monticules, concentrically laminated, where the wall shows ring of light-coloured laminae, where thin dense line of demarcation is present. Typical mesopores few (Table 6). Acanthopores numerous (Table 6), noninflecting, 8–10 at junction of four adjacent zooecia, seven to eight where three adjoin, diameter 0.02–0.04 mm, central lumen surrounded by dense, concentric laminae. Zooecia in monticules larger than those in intermonticular space (Table 6).

LONGITUDINAL SECTION—Zooecia at first curve broadly, then straighten to open nearly at right angles to surface, wall intermittently crenulated and straight in successive axial and peripheral zones, respectively, thin axially, moderately thick toward periphery, monilae few; wall laminae convex outward, diverging from central band at moderately low angle and continuing into diaphragms. Diaphragms horizontal, concave, diagonal, one or two widely spaced in axial region, commonly two or three in peripheral zone about two to three tube diameters apart. Mesopores not recognized. Structure of acanthopores most characteristic of peripheral zone, similar to that of zooecial walls.

REMARKS—Although only the types of *S. vulgaris* are here described, I examined many examples of this common Dundas species and found that the massive, irregularly shaped zoarium is invariably associated with a crinoid stem and that the microscopic detail is strikingly similar. The statement by Parks and Dyer (1922) that *S. vulgaris* is intermediate between *S. crenulata* and *S. personata* has little merit. *S. personata* and *S. vulgaris* are significantly different in: 1) number of entire mesopores in 1 mm^2 in intermonticular or intermacular areas: 2) in measurements of the apertural diameter of the zooecia in intermonticular or intermacular areas; and 3) in measurements of the apertural diameter of the zooecia in monticules or maculae (Table 7).

S. crenulata and *S. vulgaris* differ significantly in all the comparative data except the measurements of the maximum apertural diameter of the zooecia in the monticules or maculae (Table 3).

LOCALITY—Dundas Formation, Upper Ordovician, quarry Toronto Brick Company (formerly Don Valley Brickyard), Toronto, Ontario; Humber River, Toronto, Ontario.

TYPES—Holotype ROM 1091HR, hypotype ROM 1516HR.

Acknowledgments

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TABLE 1 Comparison of *Stigmatella catenulata* var. A (three sections of holotype), *S. halysa* (=*S. catenulata* var. B) (two sections of holotype), and *S. halysa crassa* (=*S. sessilis crassa*) (two sections of holotype): results of Student's *t*-tests. Measurements are given in millimetres.

N = sample size; SD = standard deviation; SE = standard error; NS = insignificant; p = probability

	S. catenulata var. A			*S. halysa* (=*S. catenulata* var. B)			*S. halysa crassa* (=*S. sessilis crassa*)			Significance	
	N	$\bar{X} \pm SE$ Extremes	SD	N	$\bar{X} \pm SE$ Extremes	SD	N	$\bar{X} \pm SE$ Extremes	SD	t	p
Number of zooecia in 2 mm in intermonticular or intermacular areas	26	9.2±0.13 8–11	0.67	22	9.2±0.13 8–10	0.59	26	9.8±0.13 8–11	0.68	A & B NS	
										A & C 2.28	< .02
										B & C 3.27	< .001
Number of entire mesopores in 1 mm² in intermonticular or intermacular areas	26	9.9±0.67 5–16	3.43	22	10.3±0.66 5–16	3.12	26	9.1±0.62 5–16	3.14	A & B 0.42	NS
										A & C 0.88	NS
										B & C 1.32	NS
Number of entire acanthopores in 1 mm² in intermonticular or intermacular areas	20	21.5±1.77 18–24	1.76	20	21.1±0.46 17–24	2.06	20	24.7±1.79 17–34	7.99	A & B 0.66	NS
										A & C 1.75	NS
										B & C 1.95	NS
Maximum apertural diameter of zooecia in monticule or maculae	24	0.25±0.01 0.19–0.27	0.02	22	0.23±0.01 0.19–0.27	0.02	22	0.21±0.01 0.15–0.26	0.03	A & B 1.53	NS
										A & C 3.84	< .001
										B & C 2.72	< .005
Maximum apertural diameter of zooecia in intermonticular or intermacular areas	30	0.15±0.01 0.14–0.19	0.01	30	0.17±0.01 0.13–0.19	0.02	26	0.14±0.01 0.13–0.19	0.01	A & B 4.85	< .001
										A & C 2.58	< .005
										B & C 7.08	< .001

TABLE 2 Comparison of *Stigmatella halysa erindalensis* (two sections of holotype) and *S. halysa* (two sections of holotype): results of Student's *t*-tests. Measurements are given in millimetres.

N = sample size; SD = standard deviation; SE = standard error; NS = insignificant; p = probability

	S. halysa erindalensis			*S. halysa*			Significance	
	N	$\bar{X} \pm SE$ Extremes	SD	N	$\bar{X} \pm SE$ Extremes	SD	t	p
Number of zooecia in 2 mm in intermonticular or intermacular areas	28	11.1 ± 0.08 10–12	0.44	22	9.2 ± 0.13 8–10	0.59	15.20	$< .001$
Number of entire mesopores in 1 mm² in intermonticular or intermacular areas	30	10.7 ± 0.56 10–16	0.67	22	10.3 ± 0.66 5–16	3.12	0.67	NS
Number of entire acanthopores in 1 mm² in intermonticular or intermacular areas	24	19.1 ± 0.94 10–26	4.60	20	21.1 ± 0.46 17–24	2.06	1.91	NS
Maximum apertural diameter of zooecia in monticule or maculae	30	0.19 ± 0.08 0.10–0.27	0.45	22	0.23 ± 0.01 0.19–0.27	0.02	4.44	$< .001$
Maximum apertural diameter of zooecia in intermonticular or intermacular areas	30	0.13 ± 0.01 0.11–0.15	0.01	30	0.17 ± 0.01 0.13–0.19	0.02	10.00	$< .001$

TABLE 3 Comparison of *Stigmatella crenulata* (two sections of hypotype) and *S. vulgaris* (two sections of holotype): results of Student's *t*-tests. Measurements are given in millimetres.

N = sample size; SD = standard deviation; SE = standard error; NS = insignificant; p = probability

	S. crenulata			*S. vulgaris*			Significance	
	N	$\overline{X} \pm SE$ Extremes	SD	N	$\overline{X} \pm SE$ Extremes	SD	t	p
Number of zooecia in 2 mm in intermonticular or intermacular areas	20	9.3±0.09 9–10	0.40	30	7.9±0.06 7–9	0.34	12.95	<.001
Number of entire mesopores in 1 mm² in intermonticular or intermacular areas	20	2.6±0.31 1–6	1.38	30	1.6±0.15 1–3	0.81	2.93	<.005
Number of entire acanthopores in 1 mm² in intermonticular or intermacular areas	20	30.0±1.19 21–38	5.32	20	22.7±0.74 19–29	3.29	5.21	<.001
Maximum apertural diameter of zooecia in monticule or maculae	20	0.25±0.01 0.20–0.28	0.02	20	0.3±0.01 0.22–0.29	0.03	1.40	NS
Maximum apertural diameter of zooecia in intermonticular or intermacular areas	20	0.18±0.01 0.14–0.23	0.02	30	0.2±0.01 0.14–0.19	0.02	3.18	<.005

TABLE 4 Comparison of *Stigmatella halysa erindalensis* (one section of holotype) and *S. hybrida* (one section of holotype): results of Student's *t*-tests. Measurements are given in millimetres.

N = sample size; SD = standard deviation; SE = standard error; NS = insignificant; p = probability

	S. halysa erindalensis			*S. hybrida*			Significance	
	N	$\overline{X} \pm SE$ Extremes	SD	N	$\overline{X} \pm SE$ Extremes	SD	t	p
Number of zooecia in 2 mm in intermonticular or intermacular areas	28	11.1±0.08 10–12	0.44	22	11.1±0.12 10–12	0.55		NS
Number of entire mesopores in 1 mm² in intermonticular or intermacular areas	30	10.7±0.56 4–16	3.08	22	1.2±0.25 0–3	1.19	12.72	< .001
Number of entire acanthopores in 1 mm² in intermonticular or intermacular areas	24	19.1±0.94 10–26	4.60	26	29.3±0.60 24–34	3.08	9.13	< .001
Maximum apertural diameter of zooecia in monticule or maculae	30	0.19±0.01 0.10–0.27	0.05	26	0.26±0.01 0.22–0.29	0.02	7.61	< .001
Maximum apertural diameter of zooecia in intermonticular or intermacular areas	30	0.13±0.01 0.11–0.15	0.01	26	0.15±0.01 0.15–0.20	0.05	2.07	< .025

TABLE 5 Comparison of *Stigmatella personata lobata* (three sections of holotype) and *S. personata* (27 specimens) (data for *S. personata* after Utgaard and Perry, 1964): results of Student's *t*-tests. Measurements are given in millimetres.

N = sample size; SD = standard deviation; SE = standard error; NS = insignificant; p = probability

	S. personata lobata			*S. personata*			Significance	
	N	$\overline{X} \pm SE$ Extremes	SD	N	$\overline{X} \pm SE$ Extremes	SD	t	p
Number of zooecia in 2 mm in intermonticular or intermacular areas	20	10.6±0.23 9–12	1.05	263	DATA NOT AVAILABLE			
Number of entire mesopores in 1 mm² in intermonticular or intermacular areas	80	1.9±0.14 0–6	1.26	230	2.0±0.13 0–11	2.00	1.90	NS
Number of entire acanthopores in 1 mm² in intermonticular or intermacular areas	60	23.0±0.87 9–40	6.55	232	21.0±0.53 7–42	8.00	2.02	< .025
Maximum apertural diameter of zooecia in monticule or maculae	35	0.2±0.01 0.15–0.30	0.04	270	0.2±0.01 0.15–0.32	0.02	1.28	NS
Maximum apertural diameter of zooecia in intermonticular or intermacular areas	56	0.2±0.01 0.13–0.26	0.02	270	0.2±0.01 0.10–0.22	0.03		NS

TABLE 6 Comparison of *Stigmatella vulgaris monticulata* (two sections of paratype) and *S. vulgaris* (two sections of holotype): results of Student's *t*-tests. Measurements are given in millimetres.

N = sample size; SD = standard deviation; SE = standard error; NS = insignificant; p = probability.

	S. vulgaris monticulata			*S. vulgaris*			Significance	
	N	$\overline{X} \pm SE$ Extremes	SD	N	$\overline{X} \pm SE$ Extremes	SD	t	p
Number of zooecia in 2 mm in intermonticular or intermacular areas	38	7.8±0.10 7–9	0.64	30	7.9±0.06 7–9	0.34	0.50	NS
Number of entire mesopores in 1 mm² in intermonticular or intermacular areas	37	1.7±0.23 0–6	1.40	30	1.6±0.15 0–6	0.81	0.37	NS
Number of entire acanthopores in 1 mm² in intermonticular or intermacular areas	20	22.0±0.89 17–24	3.98	20	22.7±0.74 19–29	3.29	0.61	NS
Maximum apertural diameter of zooecia in monticule or maculae	20	0.2±0.01 0.20–0.32	0.03	20	0.3±0.01 0.22–0.29	0.03	1.12	NS
Maximum apertural diameter of zooecia in intermonticular or intermacular areas	26	0.2±0.01 0.14–0.19	0.02	30	0.2±0.01 0.14–0.19	0.02		NS

TABLE 7 Comparison of *Stigmatella vulgaris* (two sections of holotype) and *S. personata* (27 specimens). (Data for *S. personata* after Utgaard and Perry, 1964). Results of Student's *t*-tests. Measurements are given in millimetres.

N = sample size; SD = standard deviation; SE = standard error; NS = insignificant; p = probability.

	S. vulgaris			*S. personata*			Significance	
	N	$\overline{X} \pm SE$ Extremes	SD	N	$\overline{X} \pm SE$ Extremes	SD	t	p
Number of zooecia in 2 mm in intermonticular or intermacular areas	30	7.9±0.06 7–9	0.34	DATA NOT AVAILABLE				
Number of entire mesopores in 1 mm² in intermonticular or intermacular areas	30	1.6±0.15 1–3	0.81	230	2.0±0.13 0–11	2.00	2.02	< .025
Number of entire acanthopores in 1 mm² in intermonticular or intermacular areas	20	22.7±0.74 19–29	3.29	232	21.0±0.53 7–42	8.00	1.88	NS
Maximum apertural diameter of zooecia in monticule or maculae	20	0.3±0.01 0.22–0.29	0.03	270	0.2±0.01 0.15–0.32	0.02	5.17	< .001
Maximum apertural diameter of zooecia in intermonticular or intermacular areas	30	0.2±0.01 0.14–0.19	0.02	270	0.2±0.01 0.10–0.22	0.03		NS

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